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OPINIONS FROM TEACHERS IN THE FRESNO AREA OF CENTRAL CALIFORNIA REGARDING THE INFLUENCE OF MOBILE TECHNOLOGY ON THEIR STUDENTS' LEARNING

[*Valoraciones del profesorado del área de Fresno (California central) sobre la influencia de la tecnología móvil en el aprendizaje de sus estudiantes*]

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Abstract

This paper presents the most relevant results of a study in which opinions of the teachers in the area of Fresno (Central California, USA) about the effects of the integration of mobile devices into the teaching-learning process. Among other objectives, we looked at the influence of mobile learning over three very important learning factors: affective-emotional (motivation), ethic-social (social skills) and the cognitive one (cognitive skills). In order to carry out this study, a descriptive methodological approach was adopted, using the survey technique as the most adequate method to collect teachers´ opinions in a relatively fast and precise way. Obtained results show a widespread agreement among teachers about the pedagogical potential of mobile devices as a tool to improve learning quality. In general terms, conclusions suggest an improvement in the students' interest on educational tasks, an increase during study activities, a better collaborative work, as well as an improvement of creativity and information acquisition.

Keywords

Education, teacher's perception, mobile learning, learning quality.

Resumen

En este artículo se presentan los resultados más relevantes de una investigación en la que se analizan las opiniones del profesorado del área de Fresno (California Central, EEUU) respecto a los efectos que tiene el uso de los dispositivos móviles en los procesos de aprendizaje de los estudiantes. Entre otros objetivos, se ha tratado de reconocer la influencia del uso de los dispositivos móviles en tres dimensiones importantes del aprendizaje: la afectivo-emocional (motivación), la ético-social (habilidades sociales) y la cognitiva (habilidades cognitivas). Para llevar a cabo el proceso de estudio se adoptó un enfoque metodológico de carácter descriptivo, considerando la técnica de encuesta como el procedimiento más adecuado para recoger la opinión del profesorado de una forma relativamente rápida y precisa. Los resultados obtenidos ponen de manifiesto un acuerdo bastante generalizado del profesorado sobre el potencial pedagógico de la tecnología móvil para mejorar la calidad del aprendizaje. En términos generales, las conclusiones vienen a corroborar un aumento del interés de los estudiantes por la tarea, el incremento de la actividad durante el estudio, un trabajo más colaborativo, así como la mejora de la creatividad y el proceso de adquisición de información de los estudiantes.

Descriptores

Educación, percepción docente, tecnología móvil, calidad del aprendizaje.

In recent years numerous reports have been issued by international organizations and institutions which highlight the pedagogical benefits and opportunities provided by new information and communication technologies (ICT) for innovating and improving the quality of learning processes. In these reports learning is defined as the possibility of achieving the maximum possible development of all of the students' cognitive, social and affective-emotional dimensions (Cf. EURYDICE, 2011; OECD, 2005, 2010; UNESCO, 1998, 2004, 2008, 2013). To this end, the most advanced educational systems have already implemented specific programs and initiatives aimed at promoting the use and the positive curricular integration of ICT in schools and other teaching establishments[1], in an attempt to ensure that each and every student can acquire the necessary skills to become a full and active citizen in today's information society.

In this new educational scenario, characterized by increasingly mobile technology, the student has gradually acquired a more central role and greater involvement in the learning processes taking place both inside and outside the classroom. In this way as the use of mobile devices has gradually been incorporated into the normal classroom dynamic, significant changes have occurred in the personal manner of building knowledge (Johnson, Adams and Cummins, 2012). In these cases for example students appear more active, independent and creative during their cognitive activity, they manifest positive attitudes of responsibility, commitment and collaboration with their peer group, which appear also to be accompanied by greater feelings of enjoyment or motivation during the performance of educational tasks (Attewell, Savill-Smith and Douch, 2009).

Obviously none of the above could take place without the undisputed, essential presence of the teacher, who is increasingly important as a key agent to implement change and innovation in educational processes in schools (Jara, Claro and Martinic, 2012; Martín-Laborda, 2005). These changes are largely related with the pedagogical potential offered by emerging technologies to teaching professionals to improve the quality of the learning process in various important ways: in all things relating to the information acquisition processes activated by the students, in the processes of personalization and control of information, in the manner we recover information, in the learning transfer processes, in the development of new search and content creation strategies and by offering new possibilities for teamwork or group communication. Área, Gutiérrez and Vidal (2012, pp. 51-52) express it well, "the ICT are considered potential teaching resources that teachers must know and use. In fact, the presence and importance of ICT in almost all professional fields today is such that their use has become almost inevitable".

In this sense, the mediating role of the teacher is essential for transforming the current educational paradigms and providing effective responses to the new challenges in today's society. The teacher must be capable of integrating these technologies, which are ever-present in all walks of life, into the *curriculum* in a natural way (Inan and Lowter, 2010). Teachers are considered to have the expert knowledge required to design new learning strategies and experiences with a technological base, which facilitate the development of the digital skills that are increasingly important in any discipline, subject or future profession of the student.

Having said this, and as various experts have pointed out (Camacho and Lara, 2011; Ramos, Herrera and Ramírez, 2010), in order to achieve this aim we have to build a solid theoretical framework for the methodological use and potential of mobile devices and discover their real meaning and pedagogical value. It is also important to identify those experiences and models of good practice in the use of technological resources which can serve as a reference and an example for teaching practice in its current state of evolution towards the new educational reality (Cf. Tourón and Santiago, 2013).

According to this line of thought, the aim of this paper is to find out more about the potential of mobile devices for improving the quality of students' learning. To achieve this we decided to focus our studies on the influence of the use of mobile technology on the learning experience of K-12 students. We decided to approach this from an interesting perspective, as yet relatively unexplored in this field[2], namely the perception of the teachers themselves as experts in the teaching/learning processes. In similar educational research (Bigg, 1978; Entwistle, 1981; Harris and Rosenthal, 1986; Marton and Saljo, 1976; Navaridas, 2004) it was generally accepted that the perception or idea that the teachers have about the educational context in which they are working influences to some extent how the students act during the learning process. This in turn affects their particular way of approaching their studies, which influences the quality of their learning.

Previous research and current state of the question: mobile devices in educational institutions

It is an undeniable fact that the rapid development of mobile technology in recent years has substantially transformed the way in which we communicate and relate to each other and the manner in which we create, distribute and access information and knowledge at all levels and spheres of society[3]. In the specific field of education for example, merely by observing the children and young people around us we can see that they belong to a new digital generation who think and learn in an interactive way. They are thrilled to explore anything that comes into their hands, are in constant communication with each other and are continually moving either physically or virtually. It is therefore very common to see them using mobile devices of all kinds: mobile phones[4], video game consoles, laptops or multimedia players with advanced functions such as iPods, iPads and other technological resources of a similar kind which enable them to remain connected (Ramos, Herrera and Ramírez, 2010).

Educational institutions are social creations that are committed to the full development of the human being and to strengthening his or her fundamental rights and liberties, and as such must be sensitive to these changes and respond to them adapting to the needs and demands that arise from these new learning situations. In fact in some international organizations such as UNESCO (2008) and the UN (2011)[5], ICT access is now acknowledged as a basic human right in the digital world, given that it enables people to search, assess, use and create information effectively in all walks of life in order to achieve their personal, social, professional and educational goals, defending the use of Internet as a tool which enhances the growth and the progress of society as a whole. It is therefore necessary to integrate emerging technologies into the basic *curriculum* of all educational systems as resources for generalized use and of great interest for a school population that is becoming more mobile every day.

That said, it is important to make clear what we mean by mobile electronic learning or m-Learning for short. A generally accepted definition in the field of education defines it as a method of teaching and learning which centers on the use of small maneuverable mobile devices, such as telephones, personal digital assistants, PC tablets, Pocket PCs, iPods, iPads and all other handheld devices which offer some form of wireless connectivity (Keegan, 2005; Parsons and Ryu, 2006).

From this perspective, this methodological process which is developed on the basis of mobile technology and which can be implemented at any time, anywhere and in any situation (flexibility, adaptability and ubiquity), allows the student to take an active and critical role in the construction of his own knowledge, which enables the acquisition and development of basic skills in a significant way for life (Dyson, Litchfield, Lawrence, Raban and Leijdekkers, 2009; Litchfield, Nettleton and Taylor, 2008; Naismith, Lonsdale, Vavoula and Sharples, 2004). In a similar way, Brazuelo and Gallego (2011, p. 17) define m-Learning as "the educa-

tional system that facilitates the construction of knowledge, the resolution of learning problems and the development of a variety of skills and abilities in an autonomous way, and anywhere thanks to portable mobile devices".

According to the general theoretical framework developed by different authors in relation to learning processes (Fernández Pérez, 1988; Kirby, 1984; Weinsteir and Mayer, 1986), to estimate the level of quality of the teaching that is given in a broad, flexible and dynamic, context similar to that provided by mobile devices, it is important to find out to what extent the methodology facilitates the students' integrated acquisition of three fundamental dimensions:

1. The cognitive dimension (the necessary knowledge, skills and abilities for the control, regulation and meaningful processing of information)
2. The ethical-social dimension (values, attitudes of responsibility, commitment, social skills and abilities)
3. The affective-emotional dimension (feelings of confidence, security, curiosity, interest, motivation).

The pedagogical assessment of the learning results obtained in m-Learning experiences performed in different contexts, stages and educational levels has at times been very positive. For example in a study of multiple cases by Ramos, Herrera and Ramírez (2010) in private educational institutions in Mexico, it was found that the use of M-learning resources changes the learning environment by converting any scenario into an innovative and collaborative atmosphere. This study also showed that the integration of mobile devices in the teaching process promoted the development of cognitive skills such as problem-solving, decision-making, critical thought and creative thinking.

In this same line of research, special mention should be made of the conclusions reached by Burden, Hopkins, Male, Martin and Trala (2012) on the basis of their analysis of a programme for the implementation of the iPad in various Scottish schools, in which the 1x1[6] model was adopted as the standardized format for the use of mobile technology in the teaching and learning process in the classroom. Here are some of their findings:

a) The use of mobile devices such as the iPad facilitates the achievement of many of the essential objectives set out in a *curriculum* of excellence and could be developed still further.

b) The integration of a "personalized" device such as an iPad significantly transforms the access and use of the technology in the classroom: 1) many teachers considered that the ubiquitous access to the Internet and other learning resources associated with the iPad changed the classroom dynamics and enabled a broader range of learning activities which could not have even been considered previously; 2) the device also motivated many teachers to explore alternative learning activities and assessment systems.

c) The "personal" ownership of the device is considered one of the most important factors in the success of programmes based on mobile technologies: 1) it is seen as a key factor when it comes to increasing the level of motivation, interest and commitment, improving student autonomy and self-efficacy when it comes to taking responsibility for their own learning. 2) The evidence suggests that the fact that each student has their own device can also contribute to the development of interdisciplinary activities.

d) Likewise, the fact that each teacher has their own device and can become familiar with the way it works is also a key factor in the success of m-learning.

e) As a result of the pilot studies in different educational institutions, the current plans for the implementation of educational technology were reconsidered and the more extensive use of mobile technologies was proposed:

   1. After using the iPad in schools, many of them decided that the current "non-mobile" equipment (PCs) would not be replaced in the future.

2. Many schools stated that both the teachers and the students were using iPads almost every day and in most of their school subjects.

3. It was not necessary to develop complex training plans, the use of devices was learned by experimenting with them and through collaboration with other colleagues and students.

f) The use of the device brought with it significant changes in the way in which teachers approach their work as educators and the way in which they perceive their teaching:

1. The teachers indicated that using iPads promoted collaboration between students even without the intervention of the teacher.

2. Certain applications (such as for example screen capture) supported these pedagogical changes, encouraging the creativity of the students and work in groups.

3. The teachers said that the iPads allowed them to carry out activities outside the classroom, at home and to obtain better feedback.

g) Almost 80% of families considered that the pilot study, in spite of its shorter duration had a very positive effect on the attitude of their children towards the school.

h) The Education Departments associated with the different educational authorities were perceived as fundamental support in each of the different projects.

i) Most of the teachers and students said they would have liked to continue using the iPad after the pilot study came to an end and were convinced that they had changed for the better.

In an important study of children in primary schools by Muir et al (2012)[7] , iPads were given out to 16 groups at random so that they could work with them during their conventional classes for a period of nine weeks. In total 129 students used the iPad and 137 continued with their classes in a normal way without using a tablet. All 266 students were evaluated before and after the experiment with the tablets. According to the results of literacy tests, the students who use the iPad obtained significantly better results than those who did not. Other interesting studies on this question can be consulted in the recent paper by Tourón and Santiago (2013), in which they also made an analysis of the role of the technology in special needs groups and individualized learning in the classroom, applying models such as the DT-PI (*Diagnostic Testing Followed by Prescriptive Instruction*) model.

In short all these experiences with teaching and learning processes based on new mobile technologies, which are increasingly available and established in society in general, produced very satisfactory results. This obliges the teacher to consider new methodological strategies or ways of working in the classroom that respond more effectively to the new challenges and needs arising in today's educational systems.

Purpose and objectives

Bearing in mind the previous research and the state of the question set out above, the main purpose of this study is to ascertain the opinions of teachers in the Fresno area of Central California (USA) with regard to the effects of using mobile devices in student learning processes. More specifically the objectives are as follows:

a) Identify the formats in which mobile devices are most frequently used in the K-12 period and the purposes for which they are used.

b) Analyze the degree of influence of the use of mobile technology in K-12 students' learning process, according to the teachers that use them.

c) Explore trends in the possible relations between these perceptions and the socio-educational variables of the teachers (gender, age academic qualification, teaching stage, teaching experience, pedagogical training in the use of mobile devices). These could open new avenues to enable us to explore this question in greater depth.

Methodology

Design

This kind of study lends itself to a descriptive research approach, in which we considered a survey the most suitable means of gathering the opinions of the teachers in a relatively rapid and accurate manner.

We therefore drew up a questionnaire with three basic dimensions within which we grouped the most important and significant variables in relation to the objectives of our research:

a) Personal and academic profile of the teachers (socio-educational characteristics of the teachers being studied).

b) Didactic dimension (formats and purposes of use of mobile technology in the classroom).

c) Cognitive dimension (teachers' opinions regarding the influence of mobile technology and its pedagogical potential for improving learning).

Sample

The population we studied was made up of all the K-12 teachers who use mobile devices during their teaching activities in schools in central California. From this population we obtained a sample made up of 126 teachers belonging to schools in the Fresno area. The socio-educational characteristics of these teachers can be seen in Table 1. The study sample was made by taking a simple random sample with a worst case scenario of p=q=.50, and a confidence level of 95%. The sample size was determined in the conventional manner for the case of infinite populations and when proportions are to be estimated.

Instrument

The information contained in our database was obtained by drafting an ad hoc questionnaire with a total of 13 closed questions measured by means of a 4-point Likert scale, in which the teachers were asked to give their views as to the influence of mobile technology in students' learning on the basis of their own teaching experiences in the classroom.

The questionnaire is made up of three related parts:

a) The first part collects data relating to the teachers' personal profile (gender, age, academic qualification, teaching experience, continuous formation) and about the educational context in which they teach (educational level at which they teach).

b) The second part of the questionnaire has questions about the educational process (formats and purposes of use of mobile technology during teaching). As mentioned in previous research (Navaridas, 2004), decision-making processes do not take place within a vacuum, and instead occur in a special environment of communication and interaction influenced both by a psychological context (perceptions, objectives, values, etc) and an environmental context (classroom conditions, available resources, etc).

c) In the third part the teachers expressed their opinions regarding the most important effect that they can remember on three dimensions of the students' learning, namely the affective-emotional (motivation), ethical-social (social skills) and cognitive (cognitive skills) dimensions. In this same section of the questionnaire, teachers were asked a synthesis question about their general perception as to the pedagogical potential of mobile devices for improving learning in the classroom.

Table 1. Socio-educational characteristics of the sample of teachers

CHARACTERISTICS	Nº	%
Gender		
Men	66	53.7
Women	57	46.3
Age (years)		
26 to 35	12	9.5
36 to 45	51	40.5
46 to 55	42	33.3
Over 56	21	16.7
Academic qualification		
Teaching Diploma	60	47.6
Full degree	84	66.7
Doctor	12	9.5
Others	42	33.3
Educational level at which they teach		
Primary	27	21.4
Secondary	39	31
11th and 12th Grades	39	31
Other	21	16.7
Years of teaching experience		
6 – 15	51	41.5
16 – 25	39	31.7
Over 25	33	26.8
Training in the pedagogical use of mobile technology during the last year		
Yes	60	47.6
No	66	52.4

In order to guarantee the validity of the content of questionnaire, we took into account the aspects, dimensions and items which from a theoretical framework we identified as most important with regard to the problem being analyzed in our research. We also bore in mind the opinions of seven expert judges who were asked to assess the following aspects: clarity of the instructions and the objectives of the questionnaire, structure and relevance of the elements (dimensions and items), precision of the questions, overall assessment and the possibility of adding or removing anything from it. The comments and suggestions made by the expert judges allowed us to complete and improve the exact wording until we arrived at the definitive version.

Those questions that were not descriptive of the teachers' situation were answered according to a 4-point Likert scale.

For the final design of the questionnaire, we decided that a factor analysis of the questionnaire (ordinal in this case of weak metric of the variables) would not be necessary, as proving the existence of an underlying theoretical structure was not one of the objectives of this study. The term factor in this paper must therefore be understood as the logical grouping of items that refer to the same aspect.

As regards the reliability of the instrument, we obtained the following values for the internal consistency of each of the factors (logical grouping of items): Factor 1 (purposes of use): 0.88; factor 2 (motivation): 0.91; factor 3 (social skills): 0.89 and factor 4 (cognitive skills): 0.91. All of these values are more than acceptable, as the variance of error of the scores is at the worse between 9% and 12%.

The process of delivering the questionnaire began by sending an e-mail to all the teachers that belonged to the group we targeted for analysis, in which we informed them of the purpose and objectives of our study in an attempt to encourage them to take part. They were told that when responding to the questionnaire they would be asked to remember the general behavior of their students within the context of a class in which they used mobile technology and to

identify, from their perspective as teachers, the degree of influence of these devices on each of the learning factors referred to in the questionnaire.

Data analysis

Once we had defined all the variables used in our study, we performed a number of different statistical analyses. The input data were statistically processed using the SPSS 19.0 package. We then made two types of statistical analyses. The first was a descriptive analysis of the sample and this was followed by analyses of variance in order to identify possible significant differences with respect to the different socio-educational variables considered in our study.

Results

Most frequent formats and purposes of use of mobile devices in the K-12 period

In order to analyze the different ways mobile technology is used in class by the teachers in our survey, we considered four possible formats:

1. 1x1 Model: each student has his or her own mobile device on a permanent basis, as a personal resource.
2. Mobile classroom: the devices are transported from one class to another to be used in certain specific subjects.
3. A set number of mobile devices for sporadic use: a specific number of devices in the classroom which are used from time to time and then put away.
4. Only the teacher has permanent access to a mobile device in class.

As can be observed in Figure 1, our results show that the most commonly used format in the teaching context we studied is the 1x1 model (37.5%); in other words each student has permanent access to mobile devices during the classes. However at the other extreme, it is important to point out that 28.1% of the sample group said that only the teacher had access to a mobile device during class.

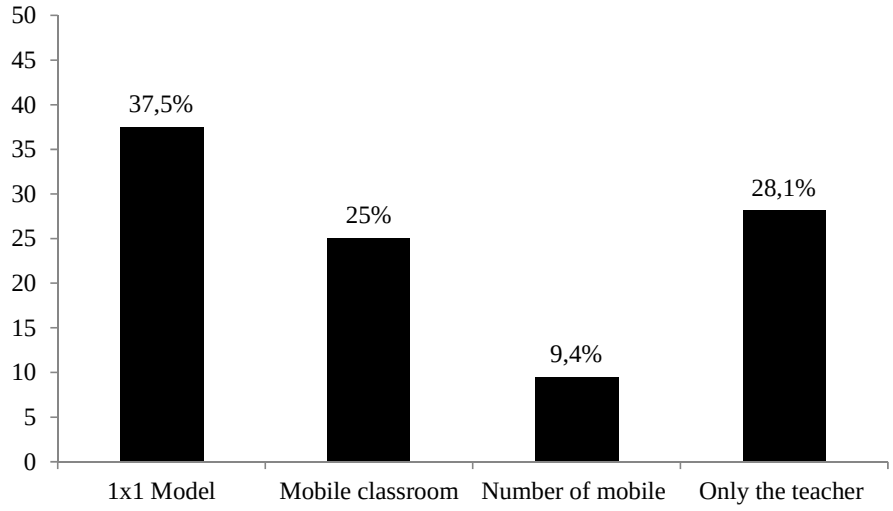

Figure 1. Formats of use of mobile technology in the classroom

If we now center our analysis on the most frequent purposes for which these devices are used, we can see (Table 2) that for all the members of our sample group, the main use of mobile technology in their teaching was in the form of *educational applications* (Mean=3.00); i.e. as a didactic support for integrating, completing or developing *curriculum* content produced by others in subjects such as Languages, Art, History, Mathematics, etc.

In the same way, the use of mobile devices as a means of *educational communication and expression* (for example the possibility of holding meetings with parents, publishing or requesting information about results/grades, exchanging opinions or sharing experiences via social net-

works, etc), and teacher *productivity* (for example, creating presentations, drafting teacher's guides, creating documents with *curriculum* contents, editing audiovisual material etc.) are also relatively frequent purposes cited by the teachers we surveyed (Mean=2.82 and Mean=2.76 respectively).

However, the K-12 teachers who took part in this study used mobile technologies less frequently for *management and administrative tasks* (for example as a system of access to files, queries, lesson planning, etc.) (Mean=2.34).

Table 2. Purposes of using mobile technology in educational processes

Main purposes of the use of mobile devices	**Mean**
Communication (for example, meetings with parents, information about grades/exam results, social networks, etc.).	2.82
Productivity (for example for creating presentations for use in class, drafting documents, editing videos, making audio materials, etc.).	2.76
Educational applications (for example integrating and developing curricular content produced by others in subjects such as languages, art, history, mathematics, etc.).	3.00
Teaching management (for example timetables, times of meetings, file access systems, queries, lesson planning, etc.).	2.34

Degree of influence of the use of mobile technology in K-12 students' learning in the opinion of the teachers that use them

In addition to identifying the most frequent formats and purposes of use of mobile devices in the classroom, we thought it would be interesting to find out the opinion of the teachers in relation to the possible influence of these devices on their students' learning. The first question the teachers were asked was of a general nature about the pedagogical potential of mobile devices to which most of them responded that the use of these devices: "*Has great* (53.1%) *or significant* (37.5%) *pedagogical potential for improving the learning process in the class*". By contrast only 9.4% of the teachers questioned considered that new technologies were neither good nor bad in themselves for improving learning and that *the didactic potential lies in the way these resources are used in the teaching context.*

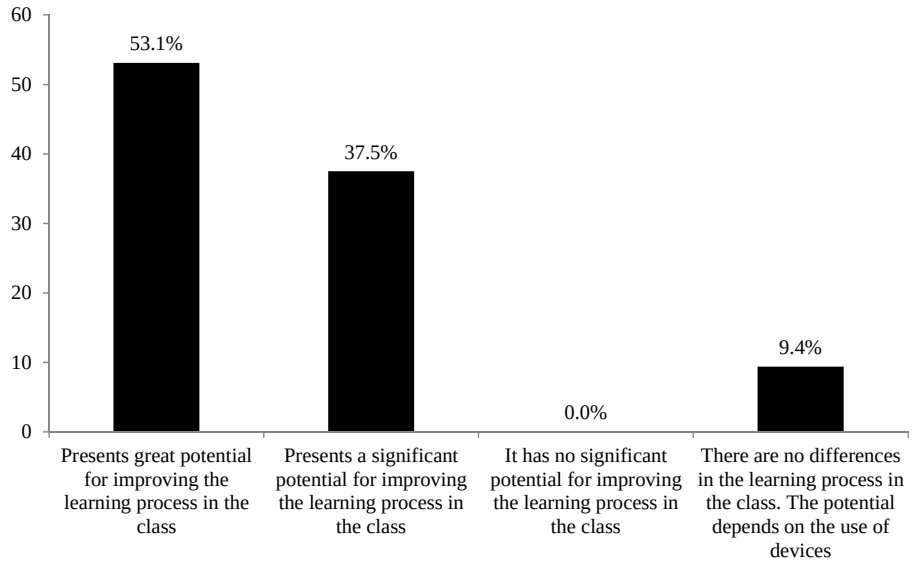

Figure 2. Teachers' perception about the pedagogical potential of mobile technology for improving the learning process in the classroom.

In this section we tried to find out more about teachers' opinions as to the effect of the use of new technologies on the main components of the three factors affecting the quality of stu-

dents' learning processes: motivation (personal interest in the subject, security and self-confidence, value of the task, activity), social skills (cooperation and collaborative work, interpersonal communication and empathy, conflict resolution, taking on responsibilities and commitment) and the cognitive skills (acquisition of relevant information, analysis and synthesis, assessment and management of information, problem-solving and decision-making, production and creation of new ideas or content). The most important results for each of these factors are set out below (Table 3).

Table 3. Teachers' opinions about the degree of influence of mobile technology on students' learning

Influence of mobile technology	
Motivation	Mean
Stimulates the students' personal interest in the topic being studied (arouses curiosity, increases attention span, etc.).	2.97
Enhances security and confidence of students during performance of the task.	2.59
Enables students to discover the value of the task (the point of learning, the usefulness of what they do, etc.).	2.69
Increases activity (stimulates student-device-learning-content interactivity).	3.19
Social skills	
Enhances cooperation between students and collaborative work in performing joint or shared tasks.	2.59
Increases interpersonal communication and empathy towards others.	2.56
Improves their capacity to manage and resolve conflicts.	1.74
Enables them to take on responsibilities and develop an ethical commitment.	2.03
Cognitive skills	
The acquisition of relevant information from diverse fields of study.	2.97
The analysis and synthesis of information.	2.90
The assessment and management of information form diverse sources.	2.88
Problem-solving and decision-making.	2.31
Creating new ideas and/or content.	3.25

In general, as can be seen in Table 3, the teachers believe that the use of mobile technology in the classroom has relatively important benefits for the motivation of K-12 students. In particular it seems to increase their *personal interest in the task* (Mean =2.97) and the *level of activity* during the learning process (Mean=3.19). Within this same dimension of analysis, teachers gave relatively lower scores to motivational aspects such as *the value the student attributes to the task* (Mean=2.69) and the *security and confidence* that the student acquires in him/herself during the educational activity (Mean=2.59), suggesting that the use of mobile devices has less influence on these aspects.

If we move onto the ethical-social dimension of our study and look at social skills, the results we obtained show a relatively significant influence of mobile devices on certain social skills which are considered important in the students' educational process, as seen from the perspective of the teachers we surveyed. On this question it is important to note the positive effects of these resources on skills typically arising in teamwork such as *cooperation and collaborative work* of the student as a member of a group (Mean=2.59), *interpersonal communication* and the use of *empathy* with others (Mean=2.56), as well as *responsibility and personal commitment to tasks and duties given to the group as a whole* (Mean=2.03). Within this same section the degree of influence of the use of mobile devices on the development of students' *capacity to distinguish and resolve conflicts* is relatively less important in the opinion of the teachers (Mean=1.74).

As regards cognitive skills, the teachers consider that the use of mobile devices is influential above all in the *production and creation of new ideas or content* (Mean=3.25). In the same way in this teaching context, the teachers considered that the mobile devices facilitated the *acquisition of relevant information from different fields of study* (Mean=2.97), *the analysis and synthe-*

sis of information (Mean=2.90) and the skills required for *the evaluation and management of information from diverse sources* (Mean=2.88). However, from the point of view of the teachers, the use of mobile technologies has less influence on *problem-solving and decision-making* (Mean=2.31) skills.

Possible relations between teachers' perceptions and their socio-educational variables: trends explored

As a complement to these results, we have made various different analyses in order to identify possible relationships between the teachers' socio-educational variables (such as gender, age, educational level they teach and the pedagogical training they have received) and their opinions about the purpose of the use of mobile technology and its influence on the different components of the learning process being analyzed in this study. Some of the most important results are set out below.

In order to analyze the possible differences in the purpose of use of mobile technologies, and in the perception of teachers as to the influence of mobile technologies on the motivational aspects, social skills and cognitive skills of the students with respect to the independent variable *gender*, we performed a T-Test for comparing the means.

The results show that there are no statistically significant differences in the purpose of the use of the mobile technology on the basis of gender, and neither did we find these differences in teachers' perception of the influence of this technology on K-12 students' learning. However and with regard to the purpose of use, the opinions of the teachers about *Productivity* are worthy of note, in that men showed a greater tendency than women to use mobile technology to create presentations, generate documents, compose videos, or for example for making audio (Mean= 3.05). In the case of the teachers' opinions about the influence of mobile technology on learning, the most striking results for the *gender* variable can be found in the social skill related with *capacity for handling and resolving conflicts* (Table 4). In this case women considered that mobile technologies had a greater influence of the use of this skill (Mean = 1.86).

Table 4. Analysis of the relations between teachers' perception and gender

Purpose of the use of mobile technology		**Mean**	**Sig.**	**t**
Productivity (creating presentations, producing documents, editing videos, making audio, etc.).	Men	3.05	.039	1.132
	Women	2.61		
Influence of mobile technology on learning		**Mean**	**Sig.**	**t**
Ability to handle and resolve conflicts	Men	1.69	.044	-.392
	Women	1.86		
Acquisition of relevant information from different fields of study	Men	2.94	.051	.032
	Women	2.93		

As regards the age of the teachers, in general terms we did not observe any statistically significant differences regarding the purposes of the use of mobile technology in educational processes in school (Table 5). We did however notice some interesting results relating to the opinions of teachers about the influence of mobile devices on certain motivational aspects of K-12 students.

In particular, as can be seen there are no significant differences in the opinions put forward by teachers as to the *increase in the personal interest of students in the topic being studied (arouses curiosity, improves the level of attention to the topic being learned, etc.)*, and in their assessment of the *increase in student activity during the learning process*. For both these motivational aspects, teachers aged over 56 (Mean= 3.83 and Mean= 3.67) and those between 36 and 45 years old (Mean= 3.00 and Mean= 3.46) expressed the most positive opinions as to the influence of the use of mobile technologies on these aspects of the motivation of their students, albeit without significant differences between them.

Table 5. Analysis of the relations between teacher's opinions and age

Influence of mobile technology on student motivation		Mean	F	Sig.
Stimulates the personal interest of students in the topic being studied (arouses curiosity, improves the level of attention to the topic being learned, etc.).	26 to 35 years old	2.67	2.956	.049
	36 to 45 years old	3.00		
	46 to 55 years old	2.50		
	Over 56 years old	3.83		
Increases activity (boosts student-device-learning content interactivity.	26 to 35 years old	2.67	2.426	.087
	36 to 45 years old	3.46		
	46 to 55 years old	2.70		
	Over 56 years old	3.67		

In this same line of analysis, we tried to discover if there are certain significant differences in terms of the educational level or stage at which the teachers in our survey teach. As can be seen in Table 6, the data we obtained does not reveal statistically significant differences in the opinions of the teachers about the influence of mobile devices on cognitive skills related with the *capacity of the student to assess and manage information from diverse sources*. Teachers who work in secondary education (Mean= 3.44) and 11th and 12th Grades (Mean= 3.00) gave higher scores for the influence of the use of these devices on this particular cognitive skill of their students.

Table 6. Analysis of relations between teachers' opinions and the educational level at which they teach

The influence of mobile technology on cognitive skills		Mean	F	Sig.
The assessment and management of information from diverse sources.	Primary education	2.50	2.416	.087
	Secondary education	3.44		
	11th and 12th Grade	3.00		
	Other	2.20		

Lastly we examined the variable regarding the priºor training that teachers had received in the pedagogical use of mobile technologies. We tried to identify possible differences in teachers' opinions about the influence of mobile devices on students' learning. The results we obtained in an analysis of variance showed differences in some of the cognitive skills of the K-12 students on the basis of whether or not the teachers had received pedagogical training in the use of mobile technology in the classroom. These differences were significant with a confidence level of 95% in the teachers' opinions regarding the ability of students to *acquire relevant information from different fields of study*, and the ability to *assess and manage information from diverse sources* (Table 7). For both cognitive skills, the teachers who had received previous training in the pedagogical use of mobile technology give a higher score for the influence that these resources have on the development of these skills in the students (Mean= 3.35 and Mean= 3.24 respectively).

Table 7. Analysis of the relation between teachers' perceptions and previous pedagogical training of teachers in the use of mobile technology

Influence of mobile technology on cognitive skills		Mean	F	Sig.
Acquisition of relevant information from different fields of study	No	2.53	5.423	.027
	Yes	3.35		
Assessment and management of information from diverse sources	No	2.47	5.272	.029
	Yes	3.24		

Conclusions

After analyzing the results and in view of the objectives of the study, we can conclude that:

a) The descriptive results from the personal and contextual variables analyzed in this study revealed the following general profile for the teachers taking part: a relatively young teacher (36-45 years old), with a degree, who teaches in secondary education with an average level of teaching experience (between six

and 15 years) and *with no significant training in in the pedagogical use of mobile technology*. Some of these characteristics must undoubtedly serve as indicators for reflection when it comes to defining the *model of teacher* that the educational authorities opt for and seek to encourage via teacher training strategies or policies in the context we studied. These authorities must be aware that the successful integration of new technologies in the *curriculum* depends to a large extent on an ambitious teacher training policy. To this end and in accordance with the guidelines drawn up recently by UNESCO (2013) to take advantage of the benefits offered by mobile technology, it is essential that teachers know and understand the new technological resources and the pedagogical potential for improving the quality of learning, so that they can respond effectively to the educational challenges posed by the information society.

b) *The 1x1 Model*, i.e. where each student has permanent access to mobile devices during class, was found to be the most frequent form of use of mobile devices in the context we studied. Classes in which only the teacher has permanent access to a mobile device or in which the "mobile classroom" (the devices are transported from one class to another to be used in certain subjects) predominated were less frequent. These data are especially interesting as a basis for change and innovation of teaching in the new educational scenario. For schools which aspire to genuine curricular integration of emerging technologies it is clearly not the same for all the students to each have their own mobile device in their normal classroom as for several students to have to share a device, or to use a single "computer room" in the school where they work from time to time on certain particular subjects.

c) In general terms the teachers we surveyed tend to use mobile technology as a didactic support for integrating, completing or developing curricular content produced by others (*Educational Applications*) in subjects such as languages, art, history, mathematics, etc. The use of mobile devices as a means of *educational communication and expression* (for example the possibility of holding meetings with parents, publishing or requesting information on learning assessment, exchanging opinions or sharing experiences through social networks, etc.), and the *productivity* of teachers (for example creating presentations, drawing up teachers guides, making documents with curricular contents, editing audiovisual material etc), were also relatively frequent purposes amongst the teachers we surveyed. However and contrary to the results obtained in other research by UNESCO (2013), the use of mobile technologies for *teacher management and administrative duties* was found to be a less frequent reason for using these devices in the group of K-12 teachers who took part in this study.

d) It is also important to point out that a relatively substantial majority of the teachers we studied considered that *mobile devices in themselves offer great pedagogical potential for improving learning in the classroom*. However and from a different teaching prospective, we also believe we should highlight the opinion of a relatively small group of teachers who believe that *new technologies are not good or bad in themselves* for improving learning and that the *didactic potential lies in the way these resources are used in the teaching context*. These discrepancies between the teachers, together with the purposes of use of mobile devices indicated by the teachers raise new questions about the way in which the emerging resources are being incorporated into the schools we investigated. In this way for example we must ask ourselves if the integration of these resources is being carried out simply from a technological point of view or also from a pedagogical perspective and to what extent. These questions open new avenues for research into the processes for curricular integration of mobile devices and the perceptions of the teachers directly involved in said processes.

e) In the opinion of the teachers surveyed, the use of mobile technology in the classroom has

relatively important benefits in students' learning. These include the following:

1. As regards motivation, the student's *personal interest in the task* seems to increase as does their *activity* during studying. We believe that this is an important aspect for change and innovation in education, which was also highlighted by Tourón and Santiago (2013) when they stated that the pedagogical use of mobile devices could help to improve the work of the student, creating positive learning atmospheres.
2. With regard to social skills, it improves *the cooperation and collaborative work* of the student as a member of the group, *interpersonal communication* and the use of *empathy* with others. It also enhances *responsibility and personal commitment to the tasks and duties given to the group as a whole*. To a large extent these results confirm those obtained in similar studies such as the one carried out by Nussbaum et. al. (2004) based on collaborative learning theories and the use of mobile technology for their development in the classroom.
3. As regards the cognitive skills, the students increase their creativity in the production of new ideas and content, they improve the processes of *acquisition of information* and significantly develop the *capacities of analysis, synthesis and evaluation of information*. Martín-Laborda (2005) came to similar conclusions when she analyzed the role of new technologies in the process of educational change.

f) As regards the relations between the teachers' opinions and the socio-educational variables considered in this study, we observed certain trends which we believe are of interest, as follows:

The results show that there are no statistically significant differences in the purpose of use of mobile technology on the basis of gender and neither were there differences in teachers' opinions as to the influence of said technology on K-12 students' learning. As regards the purpose of use, the clearest differences were observed in the case of *productivity* in which it was found that men tend to use mobile technologies to a greater extent than women for creating presentations, generating documents or editing audiovisual material. On the question of the influence of technology on learning, teachers' opinions regarding the social skill of conflict resolution are of particular note. In general terms women gave slightly higher scores when judging the influence of the use of mobile technologies on this skill.

As regards the *age* of the teachers and the *educational level* at which they teach, we observed no statistically significant differences in their opinions as to the influence of mobile devices. With respect to the first variable age, it is interesting to note the opinions of the older teachers with regard to the *increase in the personal interest of the students in the topics being studied (arouses curiosity, improves the level of attention to the topics being studied etc)* and their views on the increase in *the activity of the student during the learning process*. With respect to the educational level, teachers in secondary education and 11th and 12th Grades tend to give higher scores for the influence of new technologies on the cognitive skill of *assessing and managing the information from diverse sources*.

Lastly, we should point out the significant differences in the cognitive skills of K-12 students depending on whether or not the teachers had received *pedagogical training in the use of the mobile technology*. Significant differences were found in the teachers' opinions regarding the ability of students to *acquire relevant information from different fields of study*, and the ability to *assess and manage information from diverse sources*. For both these cognitive skills, teachers that had received previous training in the pedagogical use of mobile technology gave higher scores for the influence that these resources have on the development of these skills in their students.

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NOTES

[1] See for example the case of the Spanish educational system. In 2009 the central government in collaboration with the different regional governments launched the Proyecto Escuela 2.0 (School 2.0 Project) (Martín, 2011; Pérez, 2011). The aim of this Project (2009-2013) was to transform conventional school classrooms into 21st-

century digital classrooms, equipped with the sufficient technological infrastructure and connectivity to enable teachers to provide individualized attention to a student with his or her particular learning problems while the rest of the class are working; to combine the more traditional class in which a teacher presents a topic with a more dynamic class centered on the work of the student and even the acquisition of skills; to enrich individual study and learning with teamwork, in other words collaborative forms of learning; to achieve higher levels of participation of students in class, ensuring that they play a more active role and are more motivated in the personal construction of their knowledge; to improve the control of the performance of each student, of their learning rate or speed and of their difficulties and thereby reach a more accurate and objective assessment; to increase the involvement of parents in their children's learning processes by making it easier for them to communicate with teachers; to attend to the wide array of students with different intellectual capacities, interests and motivations that come together in a classroom. Santiago, Navaridas and Repáraz (2012) carried out an overview of the current situation of the Escuela 2.0 in schools in the Autonomous Community of La Rioja.

[2] According to Area (2010), after doing a great deal of research into the use of ICT in schools, the focus of study in this field should now center on assessing the impact of the use of ICT on student learning.

[3] According to a study by the Pew Research Center in 2013, 73% of adolescents (12-17 years old) in the United States had mobile phones. The percentage of children that regularly accessed the Internet was even higher at 95%. http://www.pewinternet.org/Reports/2013/Teens-and-Tech.aspx

[4] According to the results of the "Survey on Equipment and the use of Information and Communication Technologies in Homes 2010" (Spanish National Statistics Institute), 66.7% of children between 10 and 15 years old have their own mobile phone, and 97.8% of those between 16 and 24.

[5] http://www.cinup.org/susitio/index.php?option=com_content&task=view&id=818&Itemid=38

[6] When we talk about an "lx1 model" we are referring to the situation in which each student has their own device on a permanent basis as a personal resource during the teaching and learning process.

[6] http://www.loopinsight.com/2012/02/17/ipad-improves-kindergartners-literacy-scores/

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Abstract / Resumen	*This paper presents the most relevant results of a study in which opinions of the teachers in the area of Fresno (Central California, USA) about the effects of the integration of mobile devices into the teaching-learning process. Among other objectives, this study has tried to analyze the influence of mobile learning over three very important learning factors: affective-emotional (motivation), ethic-social (social skills) and the cognitive one (cognitive skills). In order to carry out this study, a descriptive methodological approach was adopted, using the survey technique as the most adequate method to collect teachers´ opinions in a relatively fast and precise way. Obtained results show a widespread agreement among teachers about the pedagogical potential of mobile devices as a tool to improve learning quality. In general terms, conclusions suggest an improvement in the students' interest on educational tasks, an increase during study activities, a better collaborative work, as well as an improvement of creativity and information acquisition.* En este artículo se presentan los resultados más relevantes de una investigación en la que se analizan las opiniones del profesorado del área de Fresno (California Central, EEUU) respecto a los efectos que tiene el uso de los dispositivos móviles en los procesos de aprendizaje de los estudiantes. Entre otros objetivos, se ha tratado de reconocer la influencia del uso de los dispositivos móviles en tres dimensiones importantes del aprendizaje: la afectivo-emocional (motivación), la ético-social (habilidades sociales) y la cognitiva (habilidades cognitivas). Para llevar a cabo el proceso de estudio se adoptó un enfoque metodológico de carácter descriptivo, considerando la técnica de encuesta como el procedimiento más adecuado para recoger la opinión del profesorado de una forma relativamente rápida y precisa. Los resultados obtenidos ponen de manifiesto un acuerdo bastante generalizado del profesorado sobre el potencial pedagógico de la tecnología móvil para mejorar la calidad del aprendizaje. En términos generales, las conclusiones vienen a corroborar un aumento del interés de los estudiantes por la tarea, el incremento de la actividad durante el estudio, un trabajo más colaborativo, así como la mejora de la creatividad y el proceso de adquisición de información de los estudiantes.
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